

Manual for Installation and Putting into Service

Softstarters S1, S2 + S3 for 3-Phase 400 V



Dear customer,

thank you for purchasing this article.

This article complies with the requirements of the pertinent European and national directives. CE conformity has been demonstrated.

To maintain the condition of this article as delivered and to ensure safe operation, you, the user, must observe this manual. Read the entire manual before putting the article into service and observe all operational and safety notices.

All information on technical data and properties is non-binding. In the interest of technical advancement we reserve the right to changes at any time.

Contents

- Softstarter for 3-phase 400 V
- Manual

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1. Safety Instructions

Please observe the following rules!

This manual belongs with the product.

It contains important information on initial operation and use of the product.

When you transfer this product to a third party, remember to include this manual.

Keep this manual for further reference.

Any damage caused by failure to comply with this manual will void the warranty. We will not bear liability for consequential damage.

- When connecting the device and putting it into service, the user must comply with all legal and technical provisions, including but not limited to VDE0100, VDE0113 (EN60204), VDE0660 etc.
- For reasons of safety and approval (CE) unauthorized modifications of and changes to the product are not allowed. Never disassemble the product. This device is sealed. Breaking the seal by opening the housing voids the warranty.
- Do not put into service any devices with a visibly damaged mains cable, motor cable or switch.
- ⚠ Pull the mains plug or the back-up fuse before connecting wires or carrying out maintenance, setting-up, or repair work. Wait for rotating masses like saw blades, planer blades, drill chucks and other revolving parts to come to a standstill.
- ⚠ Live parts may remain live even after the mains plug has been disconnected for a while.
- Check the mains supply before connecting. Wrong connections may destroy electric equipment.
- ⚠ Observe line voltage: The information on the type plate must conform with the the data of the power supply.
- Electric equipment may only be operated on a mains supply that is sufficiently protected against overcurrent.
- ⚠ The softstarter may not be operated on power from a generator with a non-stable output frequency (under load). Doing so may destroy the device.
- ⚠ Before leaving the machine without supervision for an extended work-break and before shutting down the machine, disconnect the device from the mains supply.
- Only qualified technical personnel may adjust the starting current and the ramp-up time.
- ⚠ Avoid short switching cycles. The enormous thermic load caused by frequent starting may damage the motor, the device and the electronic control PCB.
- For use in commercial facilities observe the accident prevention regulations for electric system and equipment by the Association of the Industrial Employer's Liability Insurance Associations (Verband der gewerblichen Berufsgenossenschaften).
- Operation of the product in schools, training facilities, hobby and DIY workshops must be supervised by trained personnel.
- Handle the product with care. Impact, shock or a drop from a low height will damage the product.
- Never use the product after it has been moved from a cold room to a warm room. Water condensation may destroy the product. The device needs to adapt to room temperature before you connect it to the mains supply. This may take several hours.
- Never touch the product with wet or moist hands.
- Make sure that the isolation of the entire product is neither damaged nor destroyed.
- At the place of installation and during shipping avoid the following environmental conditions: moisture or excessive air humidity, extreme cold or heat, dust or flammable gases, vapors or solvents, strong vibrations, strong magnetic fields as can be found near machines or loudspeakers.

2. Technical data

Voltage	400 V +10% ... -15% (other voltages on request)
Frequency	45-63Hz, no generator use
Nominal voltage	16.0 Aeff
Motor capacity	Up to 7.5 kW
Kick-start function	Up to 5.5 kW - to activate with jumper (only S1 + S2) For heavy-duty start-up with high static friction the motor is actuated for approx. 120 ms with a very high torque
Operating display	Bicolored LED
Adjustable start-up ramp	3 ... 15 sec (only for version S1 without current control + S3)
Adjustable start-up torque	0 ... 100% (Version S2 + S3: 8 ... 40 A)
Ready for restart after	Approx. 300 ms
Max. switching capacity	For 2x Ie - 10 sec. 60/h Tu=25° C For 3x Ie - 10 sec. 30/h Tu=25° C
Control of semiconductors	Excess temperature shutdown
Back-up fuse	16 A gL
Connection	Wago spring clamp terminals
Stripping length	8-9 mm
Diameter	0.08 - 4.0 mm ² solid-core 28-12 AWG 0.25 - 2.5 mm ² fine-strand with ferrule
Material	Case: PA6-GF30-V0 - Cover: PA6-GF10-V0
Ambient temperature	0° C ... +40° C
Storage temperature	-20° C ... +75° C
Weight	S1-400-7,5 = 405 g S2-400-7,5 = 435 g S3-400-3,0-7,5: 451g
Dimensions	65x107x103mm (WxLxH)

3. Versions

Capacity	Designation	Mod.No.	Note
3.0kW	S1-400-3,0 S2-400-3,0	8700.0130 8700.0131	without current control, requires setting of ramp-up time current controlled, with current limiter
4.0kW	S1-400-4,0 S2-400-4,0	8700.0132 8700.0133	without current control, requires setting of ramp-up time current controlled, with current limiter
5.5kW	S1-400-5,5 S2-400-5,5	8700.0134 8700.0135	without current control, requires setting of ramp-up time current controlled, with current limiter
7.5kW	S1-400-7,5 S2-400-7,5	8700.0136 8700.0137	without current control, requires setting of ramp-up time current controlled, with current limiter
3,0-7.5kW	S3-400-3,0-7,5	8700.0140	functions of versions S1 and S2 are chosseble through a switch

4. Special Features

- Gentle start-up with little impact on the electricity supply network
- Jerk-free motor start protects material
- Reduced start-up current
- Integrated bypass contacts
- Adjustable ramp-up time
- Replaces classic star-delta starters
- Two-phase controlled
- Kick-start function
- Detects rotational field and phase drop-out (when switched on)
- Optional current control
- Connected with spring clamp terminals

5. Use

- Pumps, fans, saws, conveyor belts, centrifuges, band saws, compressors etc.

6. Functional Description

Asynchronous motors are frequently started either directly or by means of a star-delta circuit. A direct start evokes extremely high start-up currents of up to seven times the nominal motor current. The star-delta circuit mitigates this problem; the phase voltage is reduced by a factor of square root of 3. However, switching from star to delta causes a considerable current peak. These starting modes may overload the electricity supply network, interfere with other consumers, cause mechanical problems and subject the entire drive to severe wear.

The solution to this problem is a softstarter. During start-up, the starter reduces the voltage in two of the three phases by means of phase control. During the adjustable ramp-up time the torque increases slowly until the full network voltage is applied to the motor. This results in a jerk-free start-up of your motor that protects both the electricity supply network and the drive. Extremely robust thyristor pairs (connected in anti-parallel) serve as switching elements.

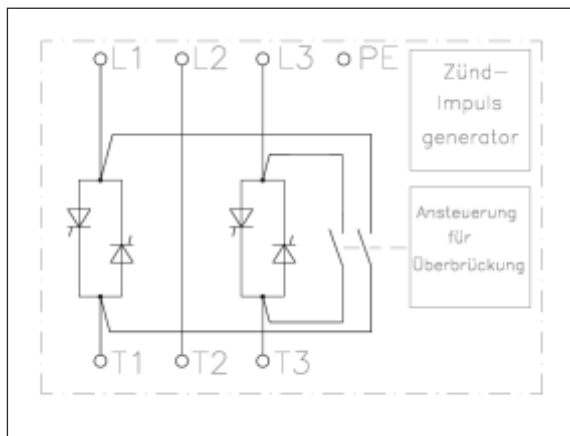
The adjustment potentiometers set the ramp-up time and the starting torque.

When a high breakaway torque is required, activate the kick-start by means of the jumper (only S1 + S2). When the motor has reached the desired speed, the control unit will actuate the bypass relays to prevent heat loss during operation.

For softstarters with current control the user sets only the desired current and thus the starting torque. The ramp-up time results from the load ratios. Should the current be insufficient to start the motor, the starter will abort the start-up attempt automatically after 30 seconds to prevent overheating.

Please note that for small voltages the torque of the asynchronous motor decreases by the square. The softstarter is therefore not suitable for drives that require a high starting torque.

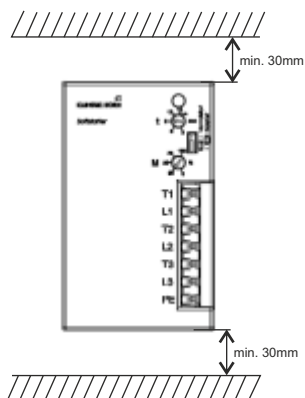
7. Block Diagram



8. Install Note


There must be a minimum vertical clearance of 30 mm between the softstarter and the wall of the housing to prevent heat accumulation.

Mount the softstarter on a 35 mm DIN rail. Slide the softstarter into the upper part of the rail and then apply light downward pressure until it snaps into place. When removing the device, use a tool to unlock the clip-on mechanism.



Ensure sufficient ventilation when the softstarter is installed inside a housing or a control cabinet. The inside temperature must not exceed 40 degree. In critical cases provide a fan in the cabinet.

9. Connecting

 The device must be connected by a qualified electrician and in compliance with the pertinent safety regulations.

Connect as follows (see description on the bottom of this page too):

Connection	Explanation
T1	motor connecting U
L1	supply network phase L1
T2	motor connecting V
L2	supply network phase L2
T3	motor connecting W
L3	supply network phase L3
PE	protective ground connection

 It is mandatory to ground the motor.

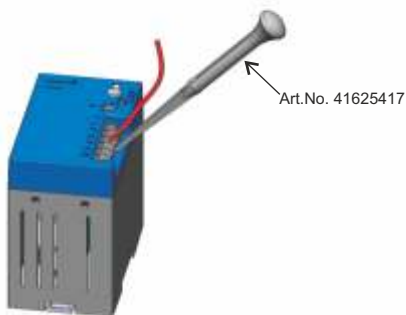
The softstarter works with star and delta connection motors.

Refer to the motor documentation for the correct connection method.

Wrong connections may destroy the motor.

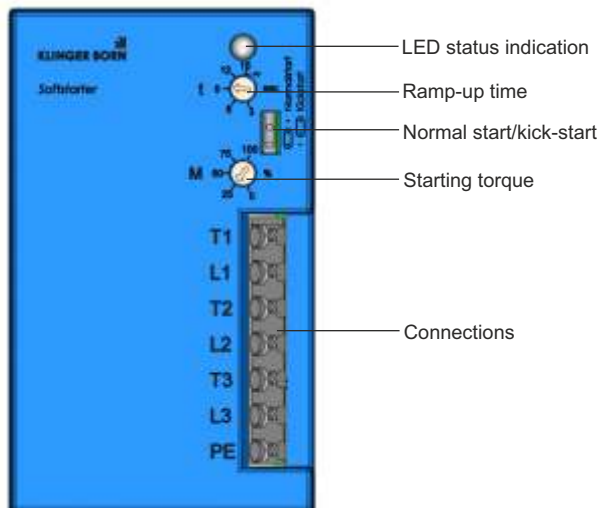
 It is not possible to use a root 3 connection (6-wire connection)!

Use the provided spring clamp terminals to connect the device. Use a screwdriver with a maximum blade width of 3.5 mm or the optionally available tool to open the clamps. Strip 8 - 9 mm of the wire and insert the bare wire end into the clamp (see picture). Remove the screwdriver to close the clamp.




10a. Putting into Service and Setting Up Version S1 (without current control, requires setting of ramp-up time)

Once the softstarter has been properly connected it can be put into service.



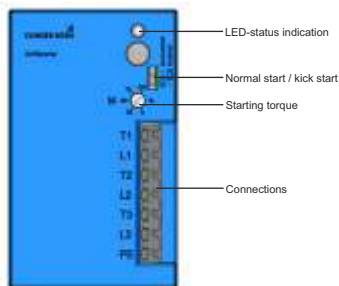
For the first start attempts set the ramp-up time to a minimum of 10 seconds, the torque to a maximum of 25% and the jumper to normal start. If the drive fails to start with these setting, or starts very slowly, carefully increase the starting torque. Adapt the torque for your application carefully.

There is an alternative way to set the softstarter: Set the potentiometer for the ramp-up time to  (adjustment mode). This is indicated by alternating red and green flashing of the LED. Increase the torque slowly from its initial low setting until you achieve optimal start-up. Then set the potentiometer for the ramp-up time to the ramp-up time you determined plus 1 - 2 seconds.

Warning: The adjustment mode is not meant for continuous operation. After adjusting the torque change the setting of the potentiometer for the ramp-up time back to normal operation.

10b. Putting into Service and Setting Up Version S2 (current controlled, with current limiter)

Once the softstarter has been properly connected it can be put into service.

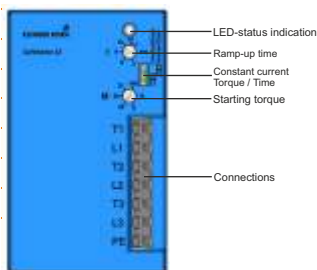


For the first start attempts set the torque to a maximum of 25% and the jumper to normal start. If the drive fails to start with these setting, or starts very slowly, carefully increase the starting torque. If the motor has not started after 30 seconds the softstarter will automatically abort the start-up attempt.

Adapt the torque for your application so that the start-up is completed in the desired time.

10c. Putting into Service and Setting Up Version S3 (current controlled, with current limiter)

Once the softstarter has been properly connected it can be put into service.



Adjustment as switch position „Constant current“, see Putting into Service type S2

Adjustment as switch position „Torque/Time“, see Putting into Service type S1

11. Control Panel

Typ S1

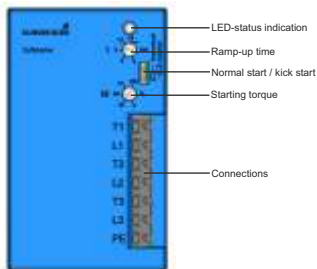


Fig.: Typ S1

Typ S2

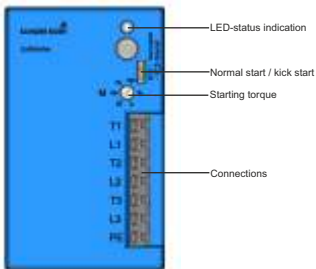


Fig.: Typ S2 -- current controlled

Typ S3

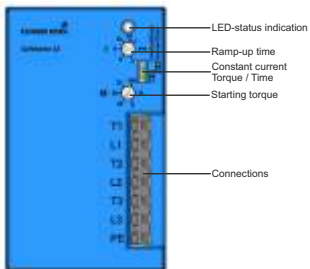





Fig.: Typ S3 -- current controlled

Setting potentiometer	Explanation
Ramp-up time (t)	<p>Setting range 3 ... 15 seconds (only version without current control)</p> <p>Please note that the start-up current increases considerably with very short ramp-up times. Therefore avoid setting too short ramp-up times. Depending on the motor and the rotating mass tried and tested times range between 6 and 12 seconds.</p> <p>Caution: Turning the potentiometer all the way to the right (150°) sets the device to adjustment mode. The ramp-up time is frozen, the start-up current (starting torque) alone determines the ramp-up time. Once you have found the correct value, set the time to the ramp-up time you have determined.</p> <p>The bypass relays will not be activated in adjustment mode. This is indicated by alternating red and green flashing of the LED.</p> <p><i>Never use this mode for normal operation!</i></p>
Starting torque (M)	<p>This potentiometer sets the starting torque. High power motors (> 4.0 kW) have coils with a very low resistance, in particular motors with star connection. This causes very high start-up currents, even with a torque setting as low as 50%. Here the setting should never exceed 50%. Field tests have shown that a setting of 25% is absolutely sufficient. The current controlled version features an overload protection. A torque setting of 0 ... 100% causes a phase current of 8 ... 40 A. If the start-up is not achieved or not detected after 30 seconds, a time-out will switch off the device. This is indicated by a red lit LED.</p>

12. LED status and Fault Indication

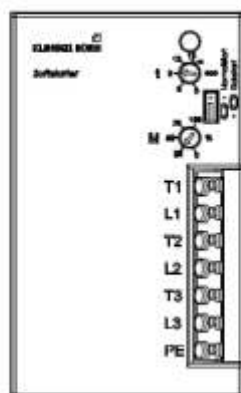
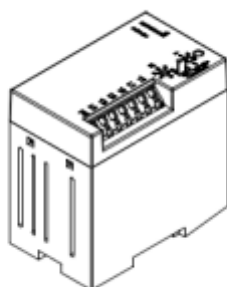
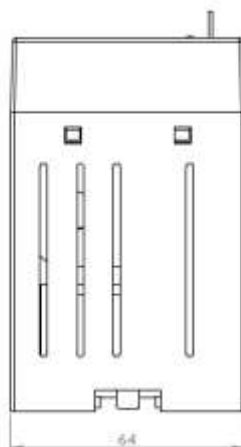
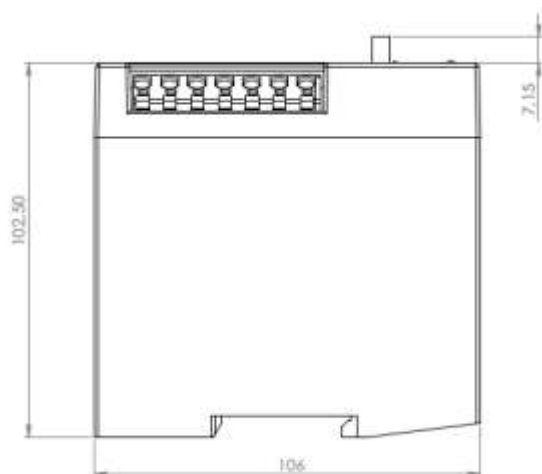
LED status indication	Explanation	Remedy
LED lights up red for about 100 ms	LED test when the softstarter is switched on	Indication of normal operation
LED flashes red	Fault indication: High temperature, restart not possible.	Let device cool for 15 minutes before restart; reduce switching frequency; provide sufficient cooling.
LED lights up red	Fault indication: Wrong direction of rotational field, phase missing or inverted, wrong frequency	Check mains connection; replace fuse if necessary; change rotation field
LED lights up red (current controlled version)	Time-out	Start-up was not achieved; increase torque
LED flashes green	Ramp-up phase	Indication of normal operation
LED flashes red and green (alternating)	Adjustment mode activated. No continuous operation !	Type S1/S3 is in adjustment mode (T= ). Set the ramp-up time after adjusting the torque. This mode must not be used for continuous operation.
LED lights up green	Operation	Normal operation; switched to bypass.
Jumper setting	Explanation	Remedy
See figure type S1 + S2	 <p>Use jumper to activate kick-start function for motors up to 5.5 kW. For heavy-duty start-up with high static friction the motor is actuated for approx. 120 ms with a very high torque.</p>	The kick-start function may be activated if the drive fails to start even with a higher torque setting. Change the position of the jumper according to the figure.
See figure type S3	 <p>Switching between Function "Current controlled with current limit " and "without current limit start-up time must be set ".</p>	If the drive do not start in operation "current controlled", select the operating mode "Torque / time". Here the time should not to settled too short, otherwise very high currents can afford.

13. Faults

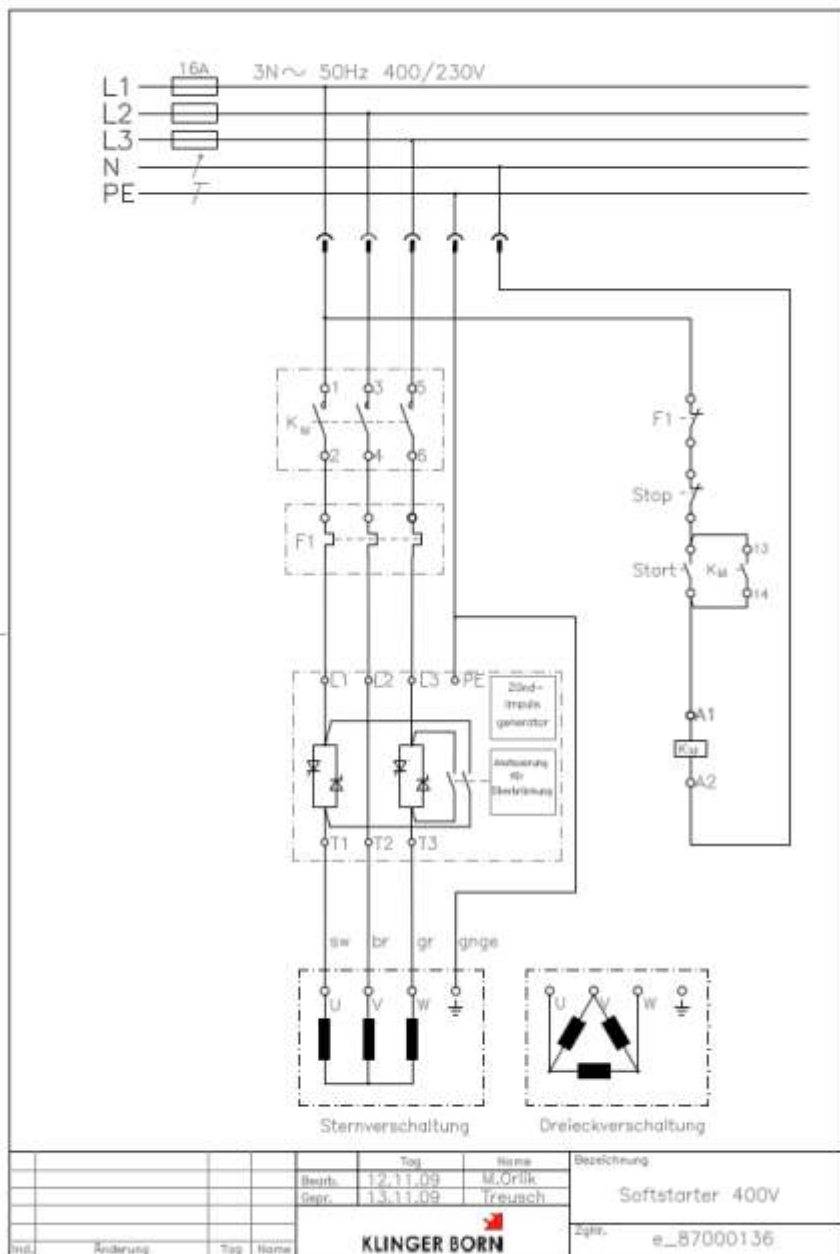
The softstarter has several monitoring features. These are indicated by means of an LED. For operational modes and faults refer to the table above.

When a fault occurs the softstarter may be reset by switching off the supply voltage.

14. Dimensional Drawing



15. Circuit Diagram - Example



16. Declaration of Conformity

We - Klinger & Born GmbH, In den Schlangenäckern 5, D-64395 Brensbach - declare in our sole responsibility that the product

Softstarter Type S1 and S2

for which this declaration is pertinent, complies with the following standards or normative documents:

DIN EN 60947-4-2

The stipulations of the following directives are pertinent:

Directive 2006/95/EC

EC EMC Directive 2004/108/EC

The component that we supply is exclusively intended for installation in or on a machine. It must not be put into service unless and until it has been determined that the machine in which the component is installed complies with the pertinent stipulations of the EC Directive.

In case of questions consult our technical service:

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